

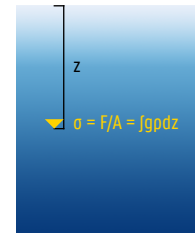
# The interplay of ice-firn model and station calibration in RNO-G.

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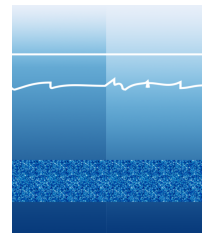
for the RNO-G collaboration

## The expected detection of signals depends on the modelling of ice properties

Ice model	describes optical properties on spatial grid	refractive index dispersion birefringence
	determines the signal propagation path	launch direction receive direction arrival time
	is in first order an isotropic single exponential based on depth	



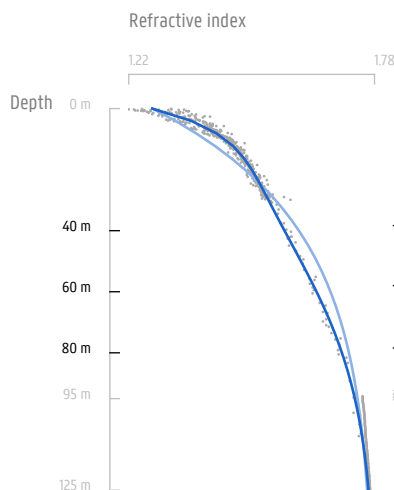
Simple exponential



Complex ice features

We compared radio calibration signals to the signal prediction of different ice models to verify the models' validity

## The onboard calibration pulser favours an exponential polynomial ice model for RNO-G



Timing discrepancy (ns)

Single exponential

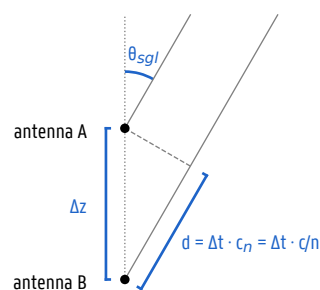
	0	1	2	3	5	6	7	9	10
10	0.0	0.2	0.0	0.2	-2.4	-4.9	-6.1	0.4	
9	-0.0	-0.1	-0.2	-0.0	-2.8	-5.1	-6.4		
7	6.3	6.4	6.2	6.5	3.5	1.5			
6	4.7	4.9	4.7	4.9	2.0				
5	2.7	2.8	2.6	2.9					
3	-0.4	-0.2	-0.3						
2	-0.2	-0.1							
1	-0.3								
0									

Timing discrepancy (ns)

Exponential polynomial

	0	1	2	3	5	6	7	9	10
10	-0.0	0.1	0.1	0.2	-1.7	-2.4	-3.3	0.4	
9	-0.1	-0.1	-0.2	0.0	-2.1	-2.6	-1.6		
7	1.4	1.6	1.4	1.7	0.8	0.8			
6	2.1	2.3	2.1	2.4					
5	1.9	2.1	1.9	2.2					
3	-0.5	-0.3	-0.4						
2	-0.3	-0.1							
1	-0.4								
0									

## Measurement from weather balloon signals agrees with both ice models



Inter-antenna timing

$$c \cdot \Delta t = n \cdot \cos(\theta) \cdot \Delta z$$

